

CLAIMS

- 5 1. Method for machining workpieces by means of a multiaxial manipulator, such as an industrial robot, with a tool moved proportionally by a control unit of the manipulator and which is able to perform characteristic movements with several degrees of freedom, wherein the degrees of freedom
10 of the tool are evaluated together with the degrees of freedom of axes of the manipulator in real time for moving a tool tip (TCP) in accordance with a predetermined machining geometry and for determining a movement of the manipulator.
- 15 2. Method according to claim 1, wherein the tool tip (TCP) is at least temporarily moved along a single, continuous machining geometry (machining path).
- 20 3. Method according to claim 1, wherein the tool tip is moved at least temporarily along a portionwise continuous machining geometry (step function).
- 25 4. Method according to claim 1, wherein evaluation takes place through the control unit of the manipulator.
- 30 5. Method according to claim 1, wherein at least coordinates of the machining geometry are entered into a control unit of the manipulator for a movement control of the tool tip.
- 35 6. Method according to claim 5, wherein the machining geometry is discretized to a sequence of discrete coordinate values with an identical time interval (cycle time) between successive values.

7. Method according to claim 6, wherein the coordinate values of the machining geometry, prior to machining, are stored in a memory unit associated with the control unit.

5

8. Method according to claim 5, wherein with the coordinates of the machining geometry are associated correction values corresponding to maximum amplitudes of the characteristic movements of the tool in the degrees of freedom thereof.

10

9. Method according to claim 8, wherein a movement path of the manipulator is dynamically determined by the control unit in that an instantaneous coordinate difference between the machining geometry and a position and orientation (pose) of the tool tip does not exceed the amplitude of the corresponding characteristic movements of the tool.

15

10. Method according to claim 1, wherein the manipulator movement path is adapted to be as short as possible and/or so as to be component-correct.

20

11. Method according to claim 9, wherein the individual coordinates of the movement path of the manipulator and as a function thereof a pose of the tool are determined with respect to the cycles of the coordinate values of the machining geometry.

25

12. Method according to claim 9, wherein the movements of the manipulator and the tool are determined between the cycles by interpolation.

30

13. Method according to claim 6, wherein the cycle time is at least periodically adapted to at least one parameter of the movements.

35

14. Method according to claim 1, wherein the movement of the tool tip takes place with a substantially constant speed.

5

15. Method according to claim 1, wherein a predetermined movement path of the manipulator, prior to machining, is stored in the memory unit associated with the control unit.

10 16. Method according to claim 1, wherein, during machining, the workpiece is moved by the manipulator.

17. Method according to claim 1, wherein, during machining, the tool is moved by the manipulator.

15

18. Device for machining workpieces, comprising a multiaxial manipulator with a control unit for movement control purposes and a tool, which for performing characteristic movements has a plurality of degrees of freedom, wherein 20 the tool and a tool tip (TCP) are movement-controllable by the manipulator control unit during the machining of a workpiece.

25 19. Device according to claim 18, wherein, during machining, the workpiece is connected to and movable by the manipulator.

30 20. Device according to claim 18, wherein, during machining, the tool is connected to and movable by the manipulator.

35 21. Device according to claim 18, wherein there is a memory unit associated with the manipulator control unit for storing at least one discretized sequence of coordinate values for a workpiece machining geometry.

22. Device according to claim 21, wherein there is a determination unit for determining deviations for the coordinate values of the machining geometry corresponding to amplitudes of the characteristic movements of the tool.

23. Device according to claim 22, wherein there are determination means for the dynamic determination of a relative pose between the tool tip (TCP) and a sum of the coordinate values of the machining geometry and wherein the associated deviations and signals generated in the determination means can be transferred to the manipulator and the tool for co-ordinated movement control purposes.

15 24. Device according to claim 18, wherein there are processor means programmed and set up for time and/or space optimization of an instantaneous movement of the manipulator utilizing the degrees of freedom of the tool.

20

25

30